



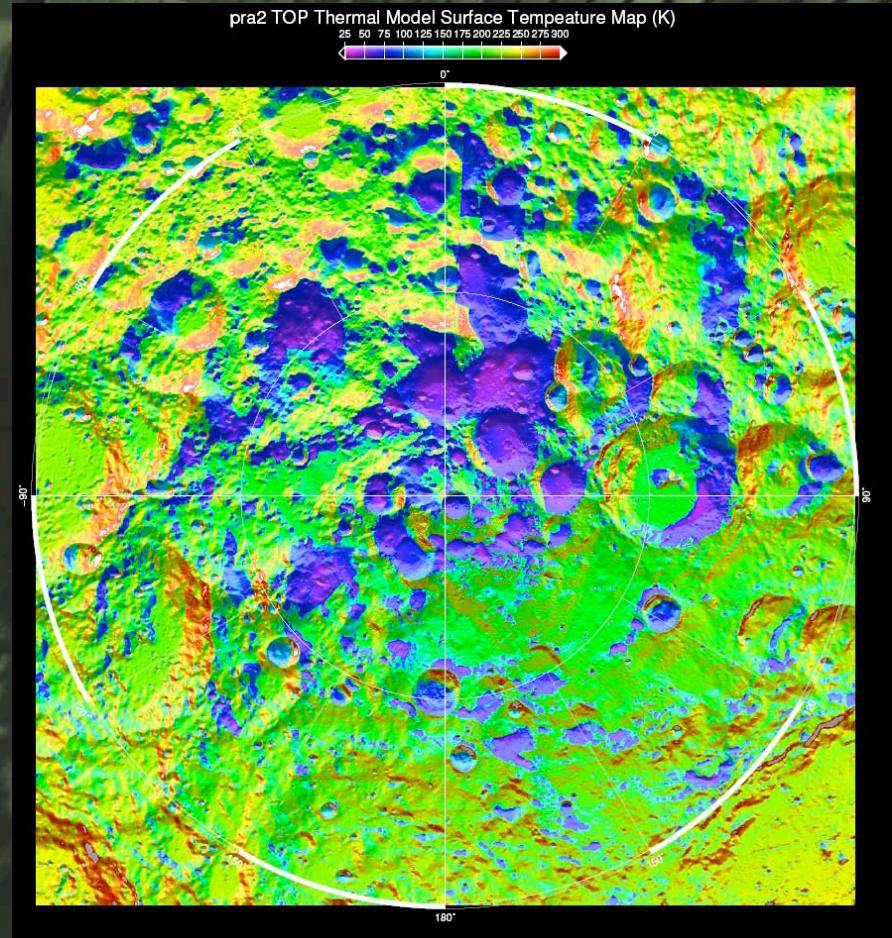
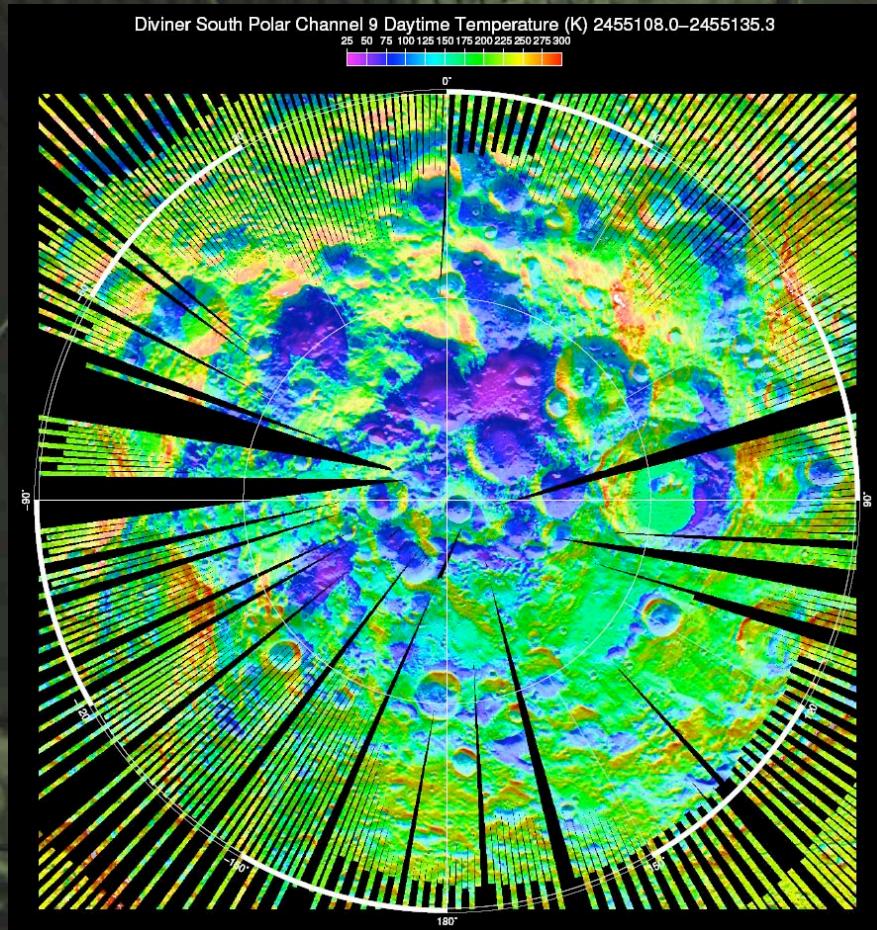
# The Evolution of Remnant Ice at the Lunar South Pole From Diviner Surface Temperature Results

R. C. Elphic, D. A. Paige, M. A. Siegler, A. R. Vasavada, V. R.  
Eke, L. F. A. Teodoro, D. J. Lawrence  
And Norbert Schorghofer

NASA Lunar Science Forum 2010



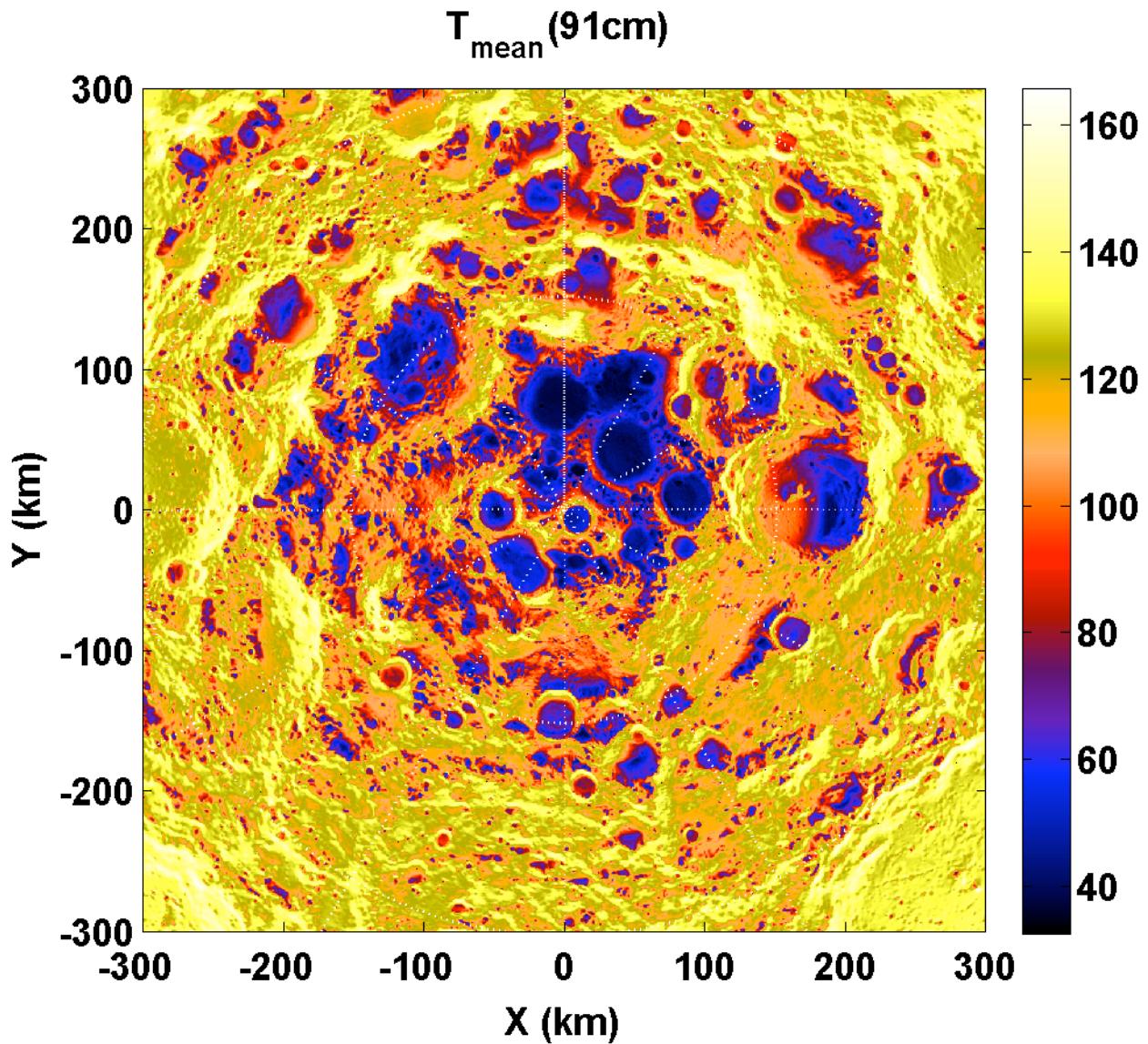
# LRO Diviner Surface Temperatures: measured & modeled



“TOP” thermal model,  
Vasavada et al. (1999)



# Model Temperatures

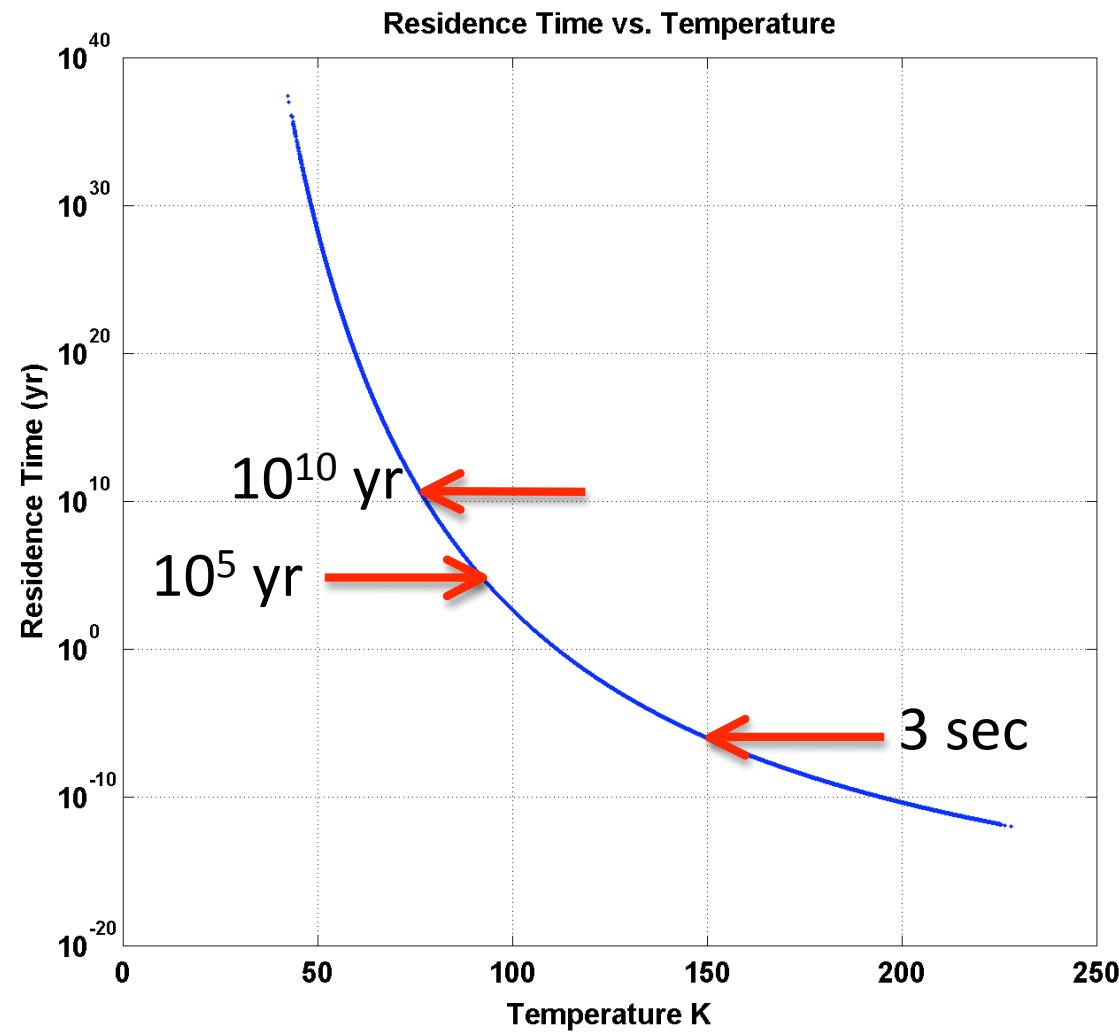


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# H<sub>2</sub>O Residence Time vs. T





# 1-D Diffusion Problem

(after Schorghofer and Taylor, 2007)



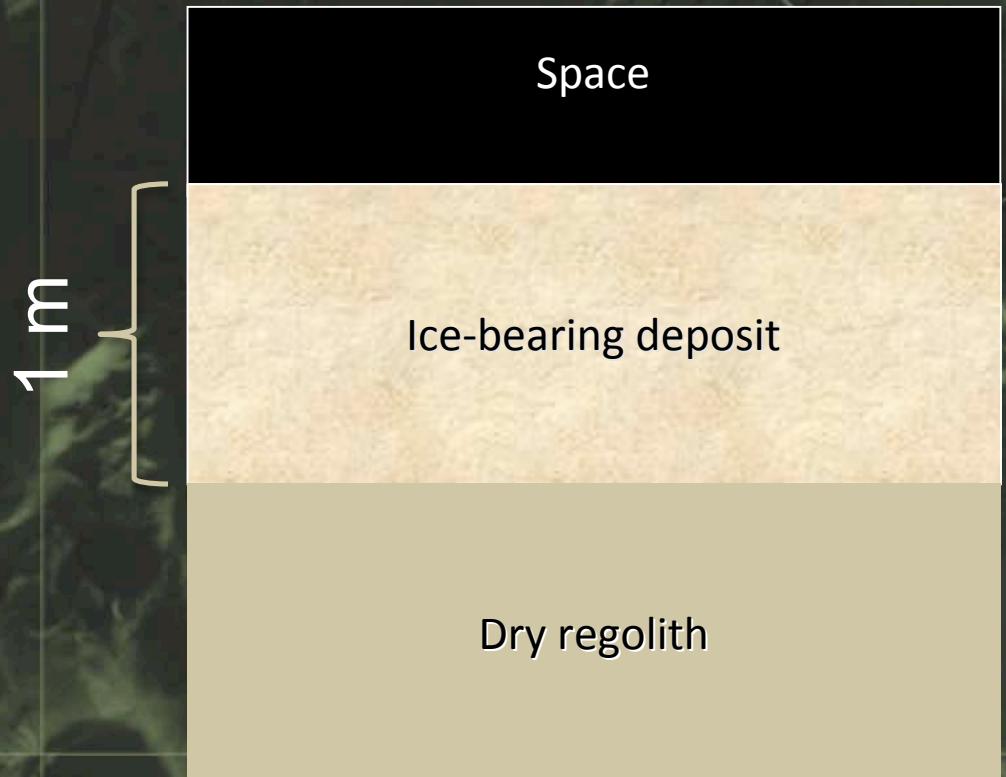
- $\delta\rho/\delta t = D \delta^2\rho/\delta z^2$
- $\rho = \text{H}_2\text{O mass density}$ ,  $\rho/\rho_o$  is initially 1 wt%
- $D$  is the isothermal diffusion coefficient,  $= l^2/2\tau_{\text{res}}$
- $\tau_{\text{res}}$  is the molecular residence time
- $l$  is the pore size,  $\sim 75 \mu\text{m}$
- Gardening: 1 meter burial/ $10^9 \text{ yr}$



# 1-D Diffusion Problem: solution for “wet” layer

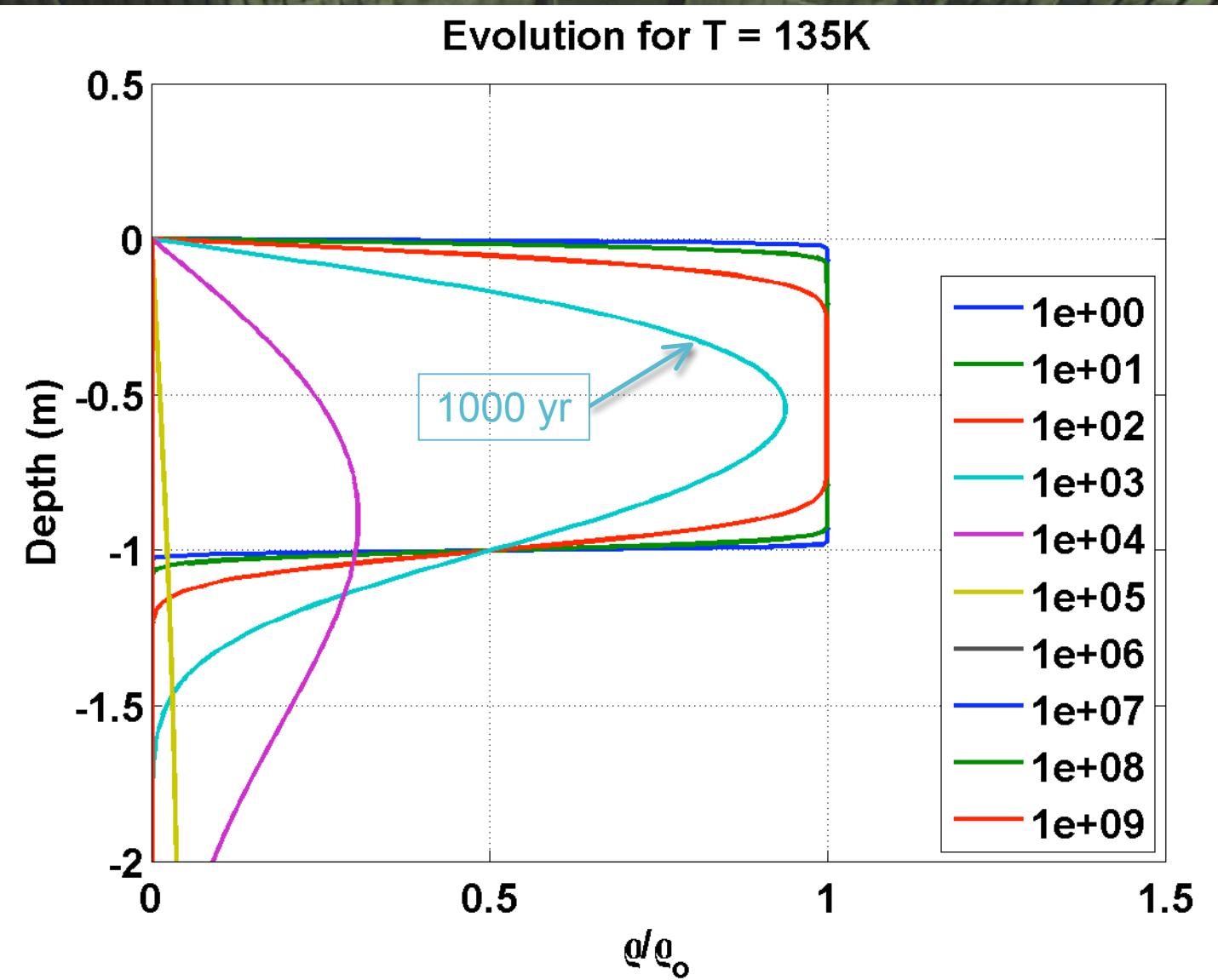


- $\rho/\rho_0 = (-\text{erf}((z+1)/\text{fac}) - \text{erf}((z-1)/\text{fac}) + 2 \text{erf}(z/\text{fac}))/2$
- $\text{fac} = \sqrt{4\pi Dt}$
- $t$  = time
- Temp = const.



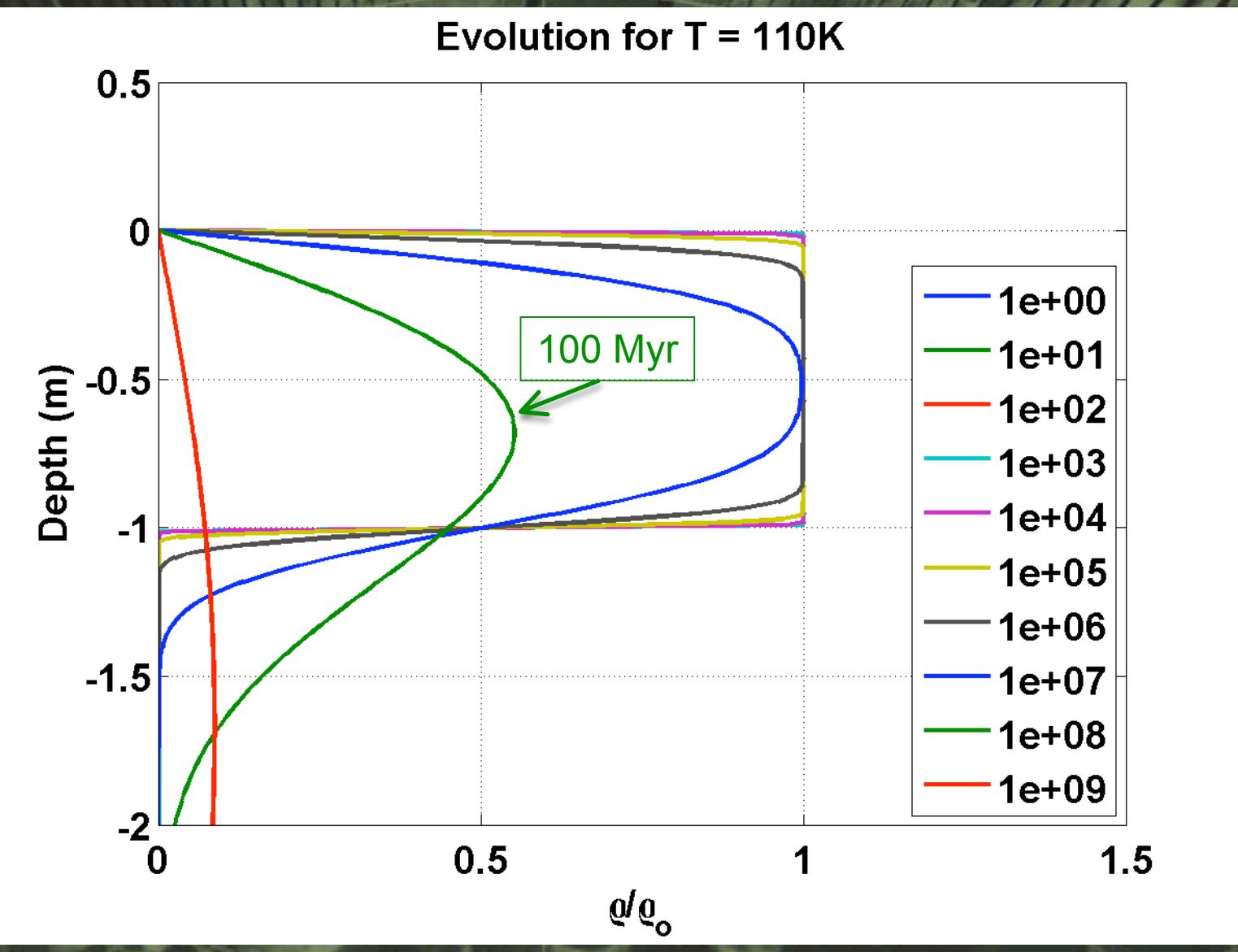


# “Global” Layer of 1-meter thick, ice-bearing “stuff”



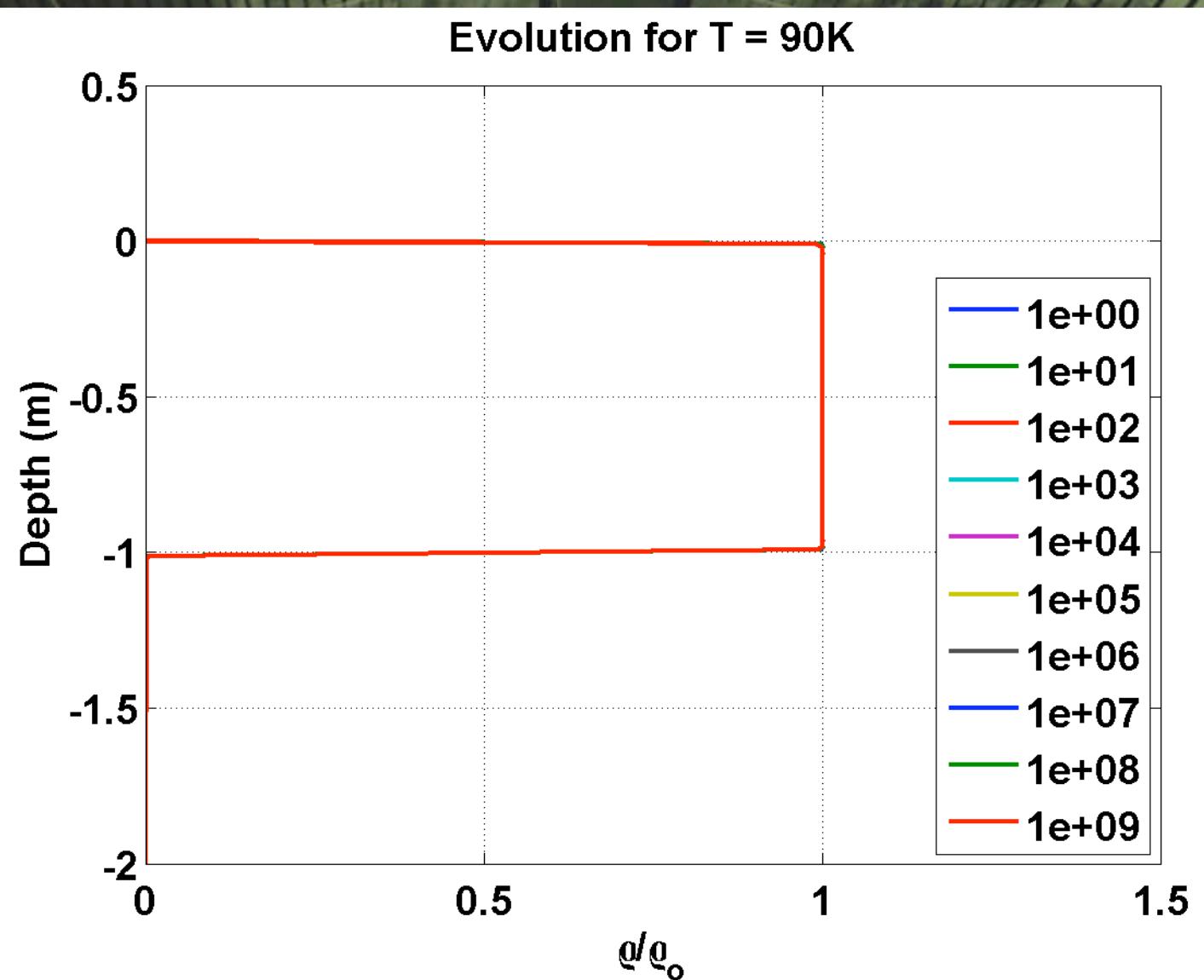


# “Global” Layer of 1-meter thick, ice-bearing stuff



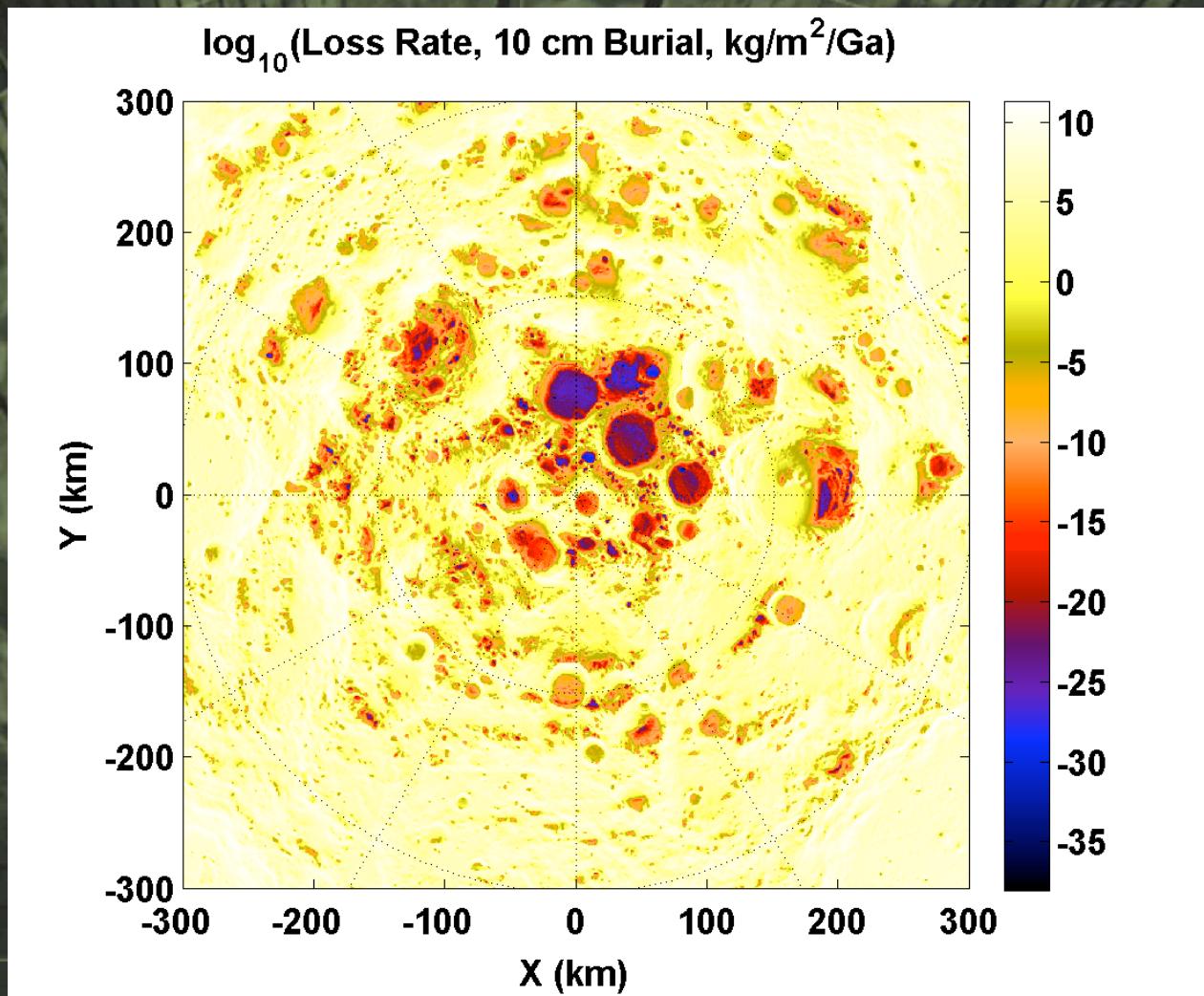


# “Global” Layer of 1-meter thick, ice-bearing stuff



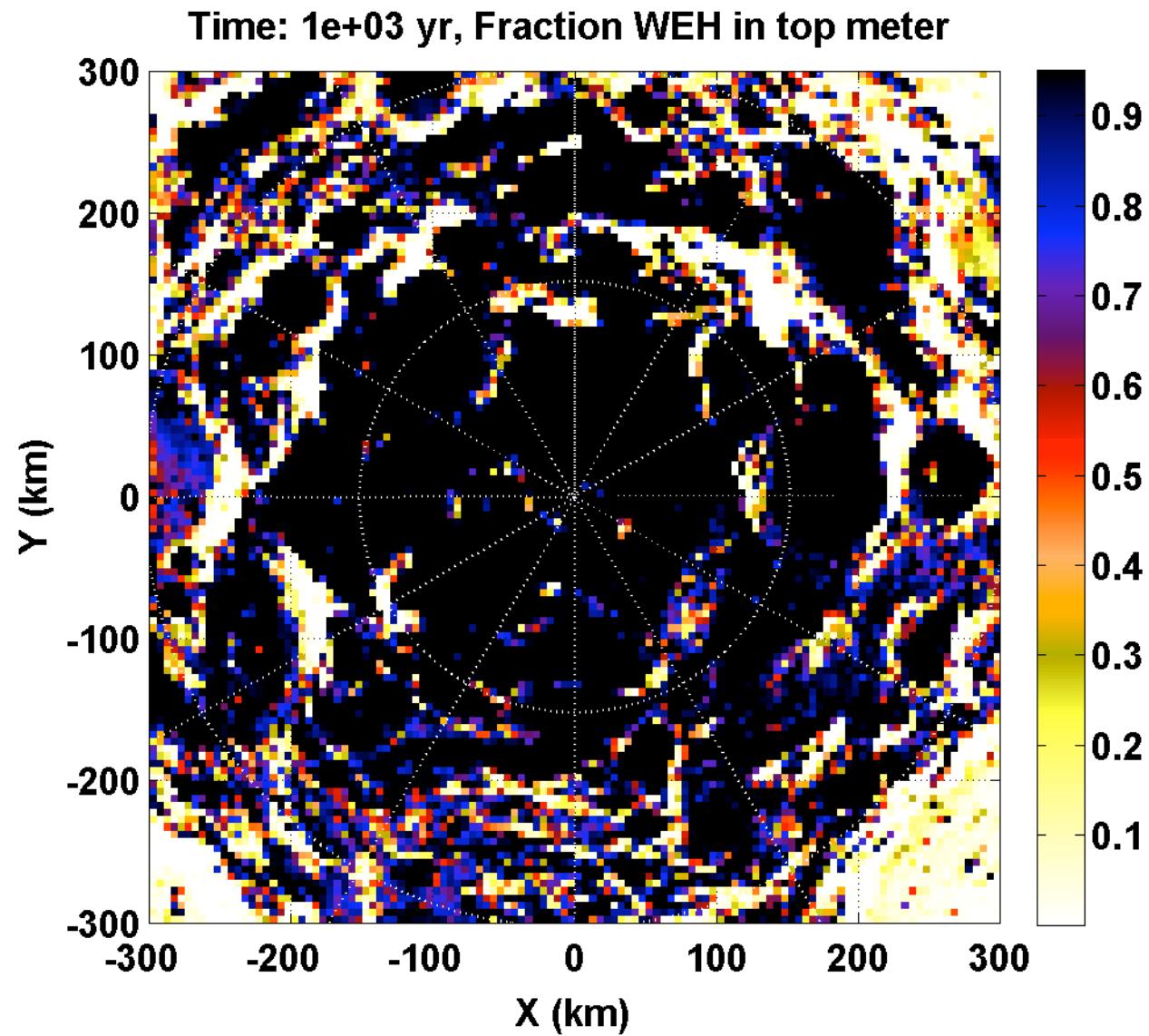


# South Pole H<sub>2</sub>O Loss Rates (log<sub>10</sub>)



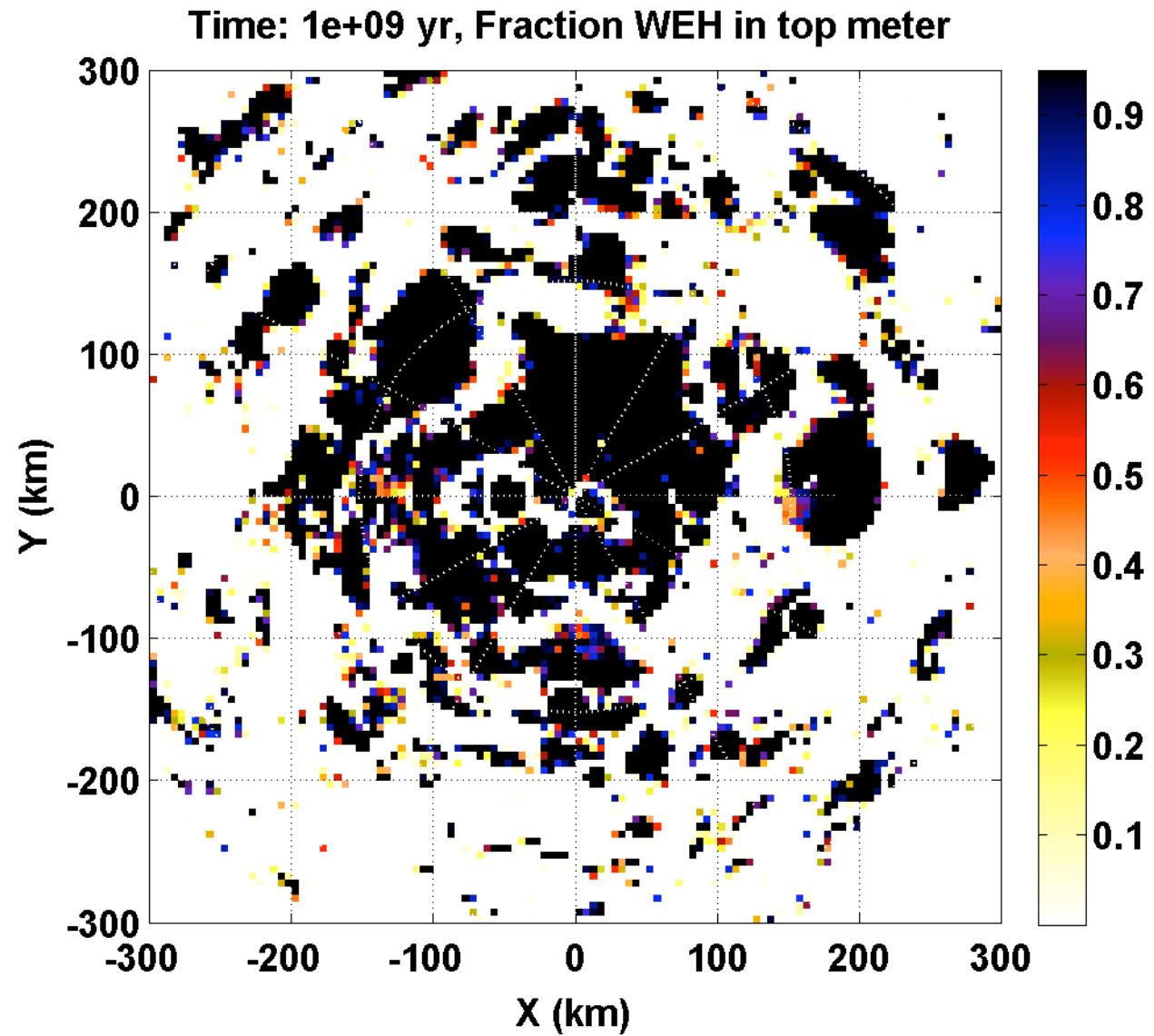


# Mean WEH Fraction in Top 1 meter



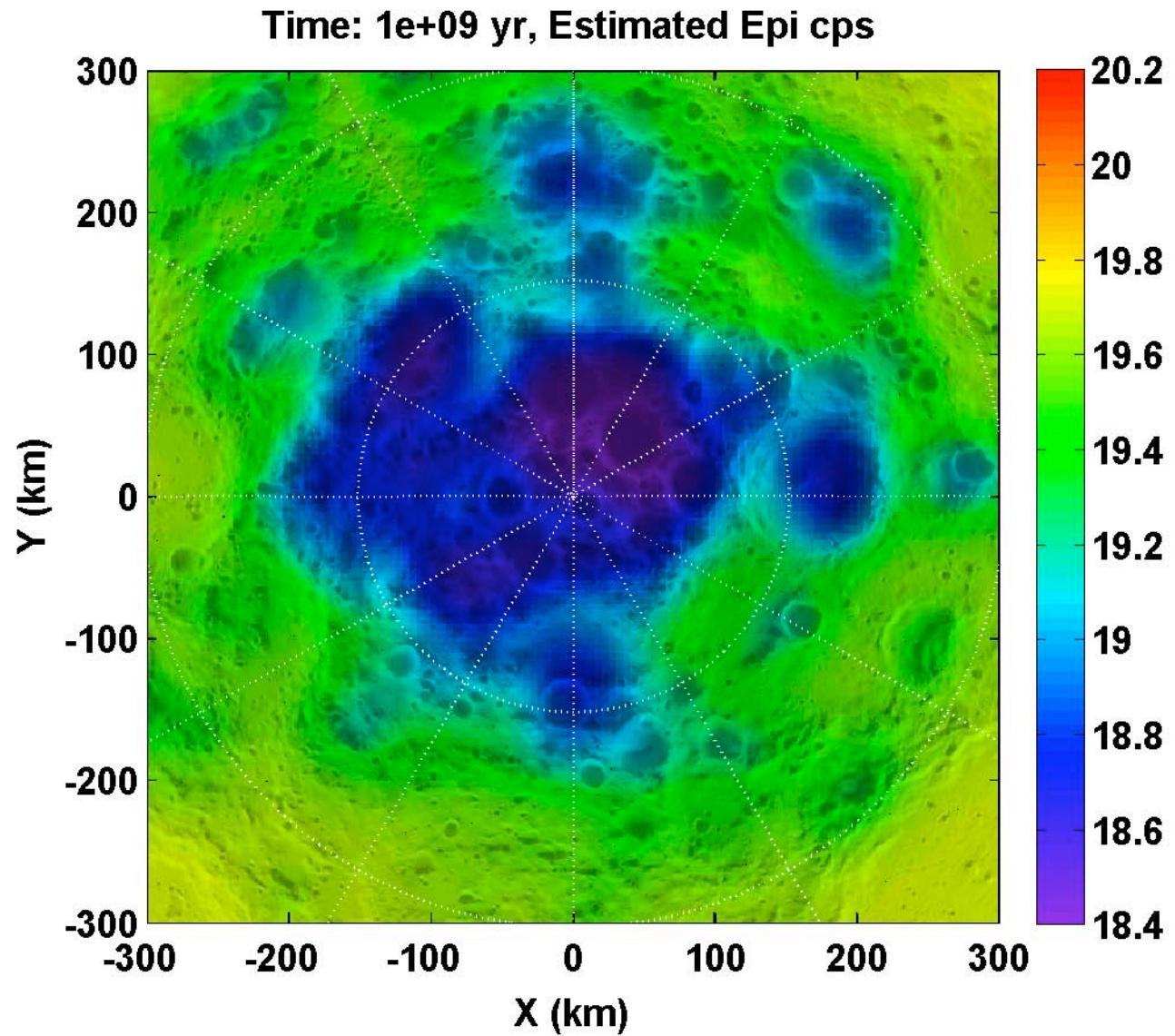


# Mean WEH Fraction in Top 1 meter



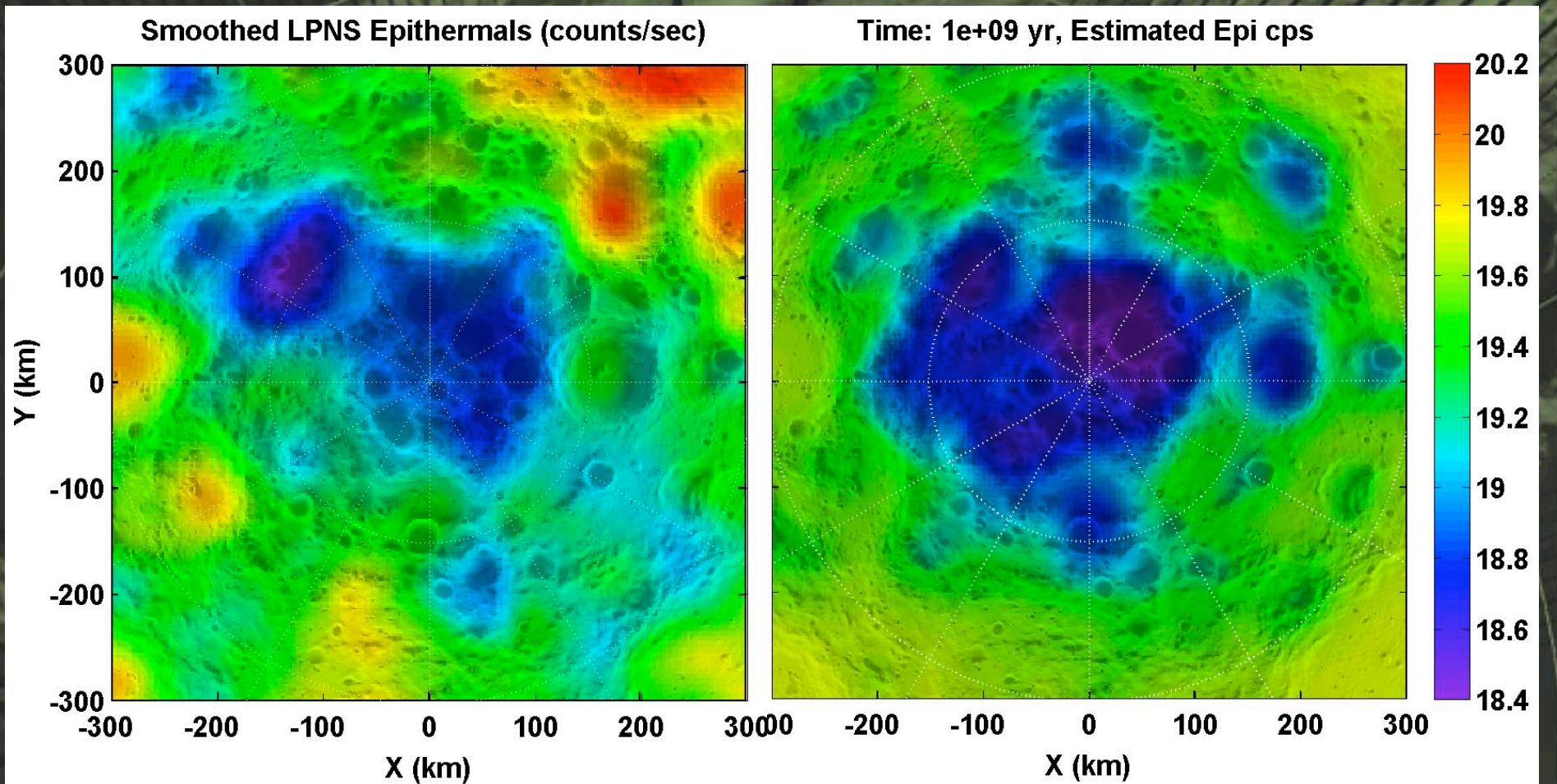


# “Apparent” Epi Neutron Maps





# Modeled Epis vs. Observed



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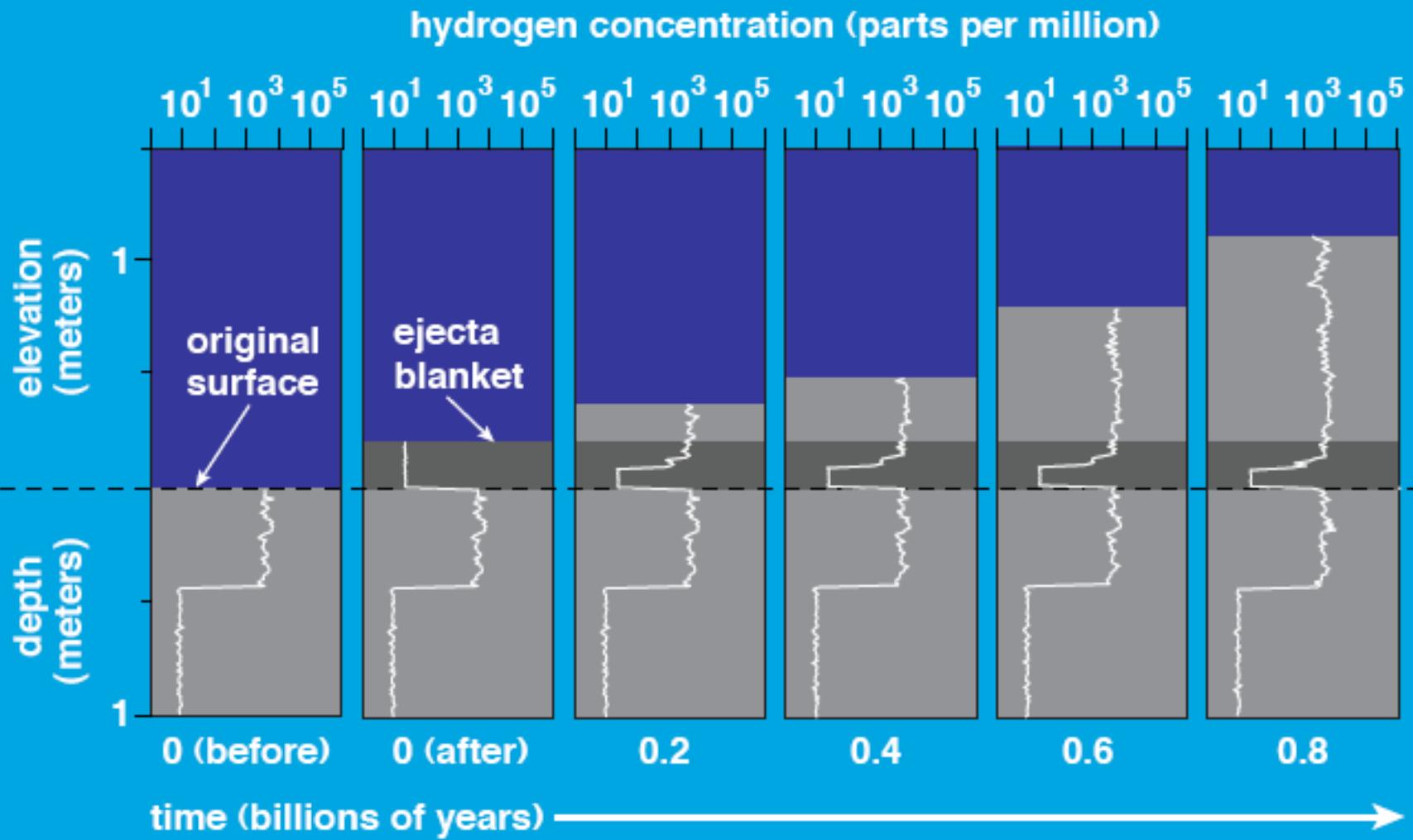
# Preliminary Results: Relict Ice



- Modeled epithermal flux spatially different from that of LPNS.
- Shoemaker/Haworth/Faustini area cannot be made to agree with eg. Cabeus for same initial conditions.
- Reconfirms what we found with Pixon reconstructions:
  - Some large cold traps do NOT have high WEH.
  - Localized sources?



# Gardening/Burial

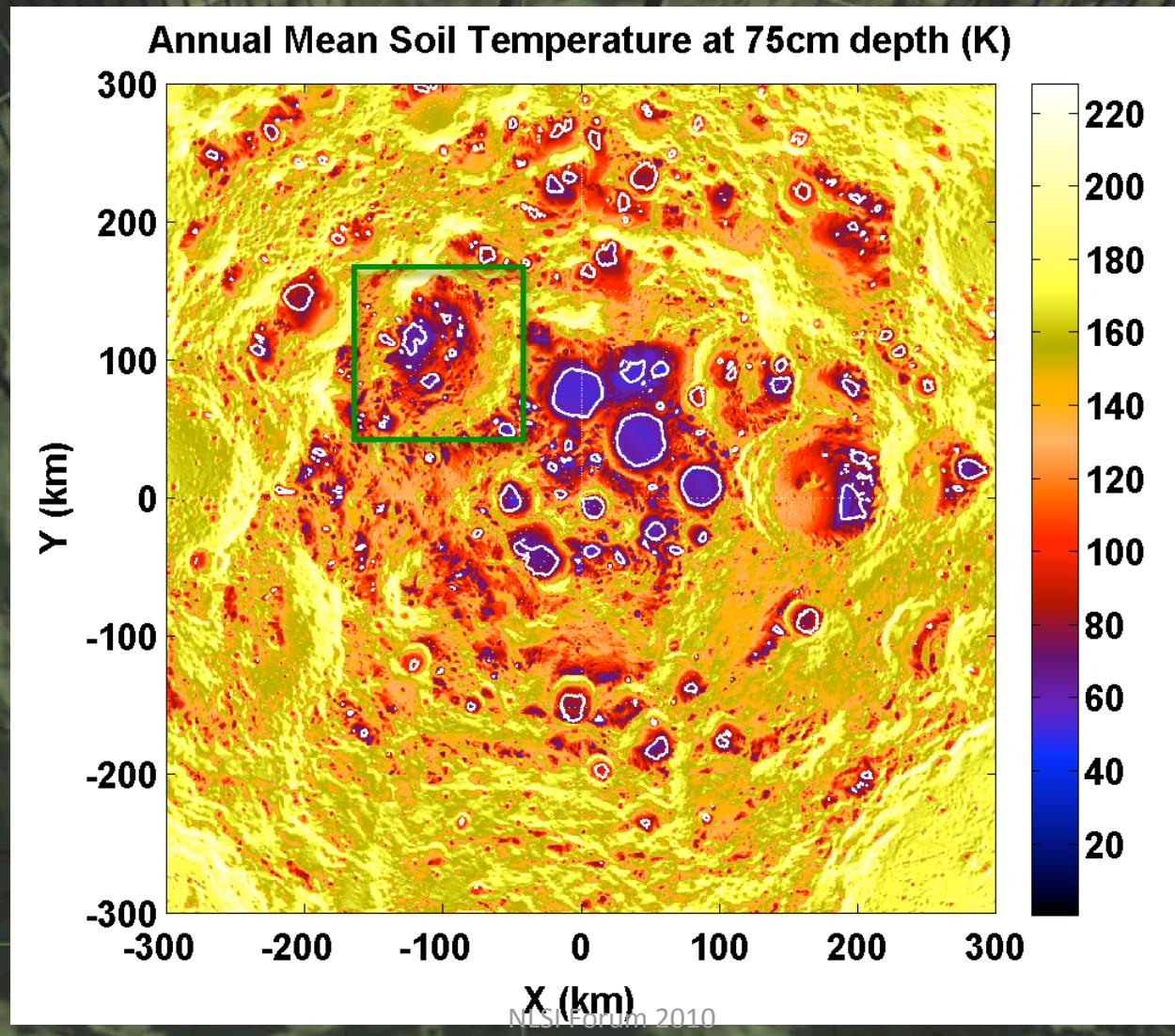




# Model Subsurface Temperature



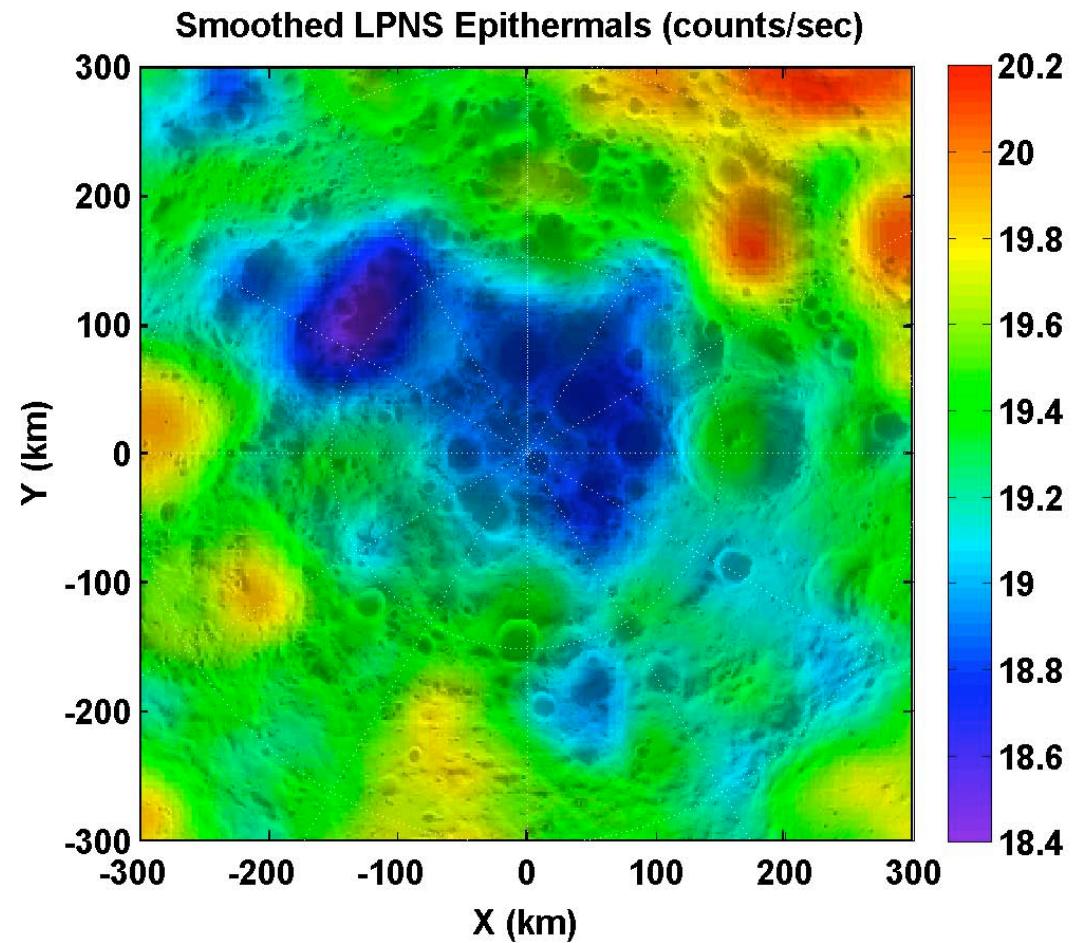
75 cm Depth



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# Is Lunar Polar “Ice” a Relic of a Single Large Event?





# LPNS minus Model

